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ABSTRACT

This report is the result of an experimental effort by the Population Studies Program at the University of Louisville. The program investigated the feasibility of estimating the percentage of Kentucky residents in poverty at the county level based on a variety of income, employment, demographic, and public assistance data available annually for counties. The results of this modeling effort were released for review and discussion. The model estimated the poverty rate from surrogate social indicators that are expected to systematically vary with poverty. The model was first calibrated on 1969 data for all counties of the state, then used to estimate the 1979 poverty rate for all counties based on the 1969 model coefficients. Results were compared with the poverty rates estimated from the 1980 census. Then the model was recalibrated using the 1979 data, and the 1979 coefficients were used to estimate the poverty rates for subsequent years. When tested against the 1980 census of the 1979 poverty rate, the model's average absolute percentage point error for 1979 was 2.4 points. The maximum error was 12.5 points and 13 of the state's 120 counties had errors exceeding 5 percentage points. Over half the counties were within 2 percentage points of the 1980 census estimate. The estimates indicated that poverty had increased in Kentucky since 1979. The estimated 1986 rate was 18.2 percent, slightly above the 1979 rate of 17.6 percent. The number of people estimated to be in poverty in 1986 was 678,000. Eastern Kentucky continued to have the highest number of counties with high poverty rates. This document details the model's calibration and contains three maps and six tables. (TES)

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ANNUAL ESTIMATES OF POVERTY FOR COUNTIES IN KENTUCKY

1979-1987

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ANNUAL ESTIMATES OF POVERTY FOR COUNTIES IN KENTUCKY 1979--1986

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INTRODUCTION

One of the measures most often requested by users of public statistics is the poverty rate. Unfortunately, there is no national source for annual estimates of poverty for local areas. Given the interest in and obvious need for estimating poverty for local levels, the Population Studies Program at the Urban Studies Center has investigated the feasibility of estimating the percentage of persons in poverty at the county level based on a variety of income, employment, and demographic data available for counties on an annual basis. This effort is experimental in the sense that the results, although promising, can best be judged by the test of time, meaning every ten years when the decennial census results become available.

The results of this modeling effort are being released for review and discussion by data users and other researchers in Kentucky and throughout the nation. Use of these estimates is left to the judgment of the individual analyst. We believe the model, as tested against the 1980 census estimate of the 1979 poverty rate, has proven to be reasonably reliable for the vast majority of counties in Kentucky. The average absolute percentage point error for 1979 was 2.4 points, over a decade in which the poverty rate changed substantially. The maximum error was 12.5 points and 13 of the state's 120 counties had errors exceeding 5 percentage points. Over half of the counties were within 2 percentage points of the 1980 census estimate. Whether or not this is an acceptable accuracy level and whether the assumptions of the model will be accurate during the 1980s can be judged only by the user.

POVERTY TRENDS IN KENTUCKY

The estimates indicate that poverty has increased in Kentucky in the 1980s when compared with the poverty rate for 1979. The estimated 1986 rate is 18.2 percent, slightly above the 1979 rate of 17.6 percent. The number of people estimated to be in poverty was 678,000, a 36,700-person increase (5.7%) over 1979. However, the trend since 1983---when poverty hit its most recent peak of 19.9 percent or 739,300 people---has been one of steady decline.

Eastern Kentucky continues to have the largest number of counties with high poverty rates. (See Figure 1.) Many counties in that region had poverty rates of 30 percent or higher in 1986. Nine counties had poverty rates above 40 percent, including the seven contiguous counties of Elliott, Morgan, Wolfe, Breathitt, Owsley, Clay, and Knox. The other two counties with such high poverty rates are McCreary and Clinton in the Lake Cumberland region. The county with the highest poverty rate is Owsley County, where an estimated 52.9 percent of the population was in poverty in 1986.

Not only does eastern Kentucky have a high rate of poverty, the rate has increased since 1979. (See Figure 2.) Fifteen of the 22 counties where poverty rates between 1979 and 1986 increased by 4 or more percentage points are in eastern Kentucky. Elliott and Wolfe counties have the unenviable position of being on the list of top ten counties in the state in terms of both the overall rate of poverty and the increase in that rate.

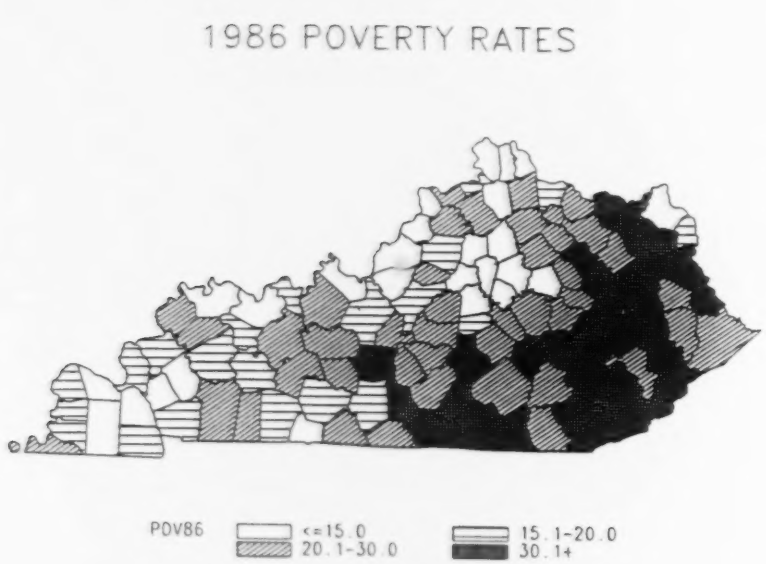

Figure 1: Map of 1986 Kentucky poverty rates*

*For names of counties, see Appendix for County Reference Map

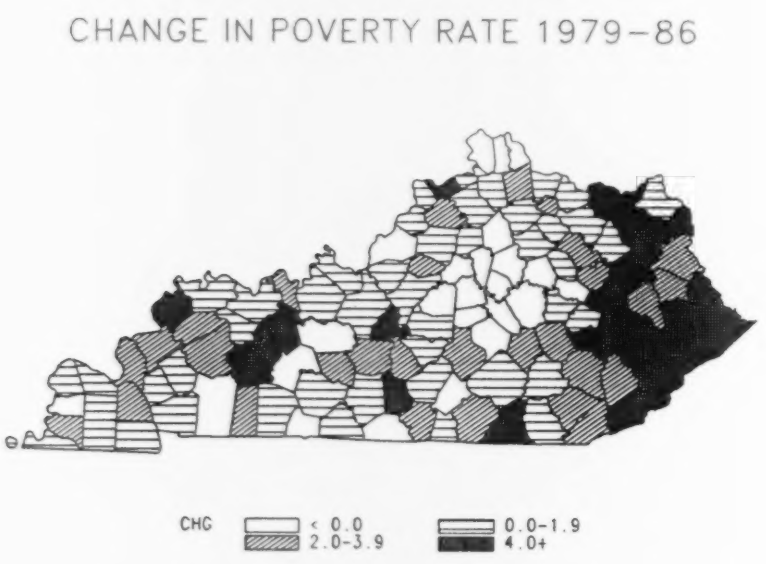

Figure 2: Map of change in Kentucky poverty rates, 1979--1986*

*For names of counties, see Appendix for County Reference Map

In contrast to eastern Kentucky, most counties in the Bluegrass Region have low poverty rates, which have continued to decline even further. Among the ten counties with the lowest poverty rates in 1986 were Fayette, Anderson, Woodford, and Franklin. The other six counties were in the Louisville and Cincinnati metropolitan areas: Jefferson, Bullitt, Oldham, Boone, Kenton, and Campbell.

The estimates indicate a decrease in the poverty rate for 24 counties. But the only significant decreases were in the Lexington metropolitan area, where the poverty rate estimates declined by 8 points in Woodford County, 4 points in Fayette County, and 2 points in Clark and Scott counties. The substantial decline in the estimated poverty rate for Woodford County was the result of per capita income increasing by 33.6 percent while per capita income maintenance payments fell by 30.0 percent (in constant dollars). In Fayette County, constant dollar per capita income increased by 12.5 percent and per capita income maintenance payments fell by 17.2 percent.

Jefferson County had the largest number of persons estimated to be in poverty in 1986 (75,500) and the largest decline in the number of persons in poverty between 1979 and 1986 (-8,900). Fayette County was second in both the number of persons in poverty (20,700) and the decline in this number (-6,700). In contrast, Pike County, with the third largest poverty population (20,300 people), had the largest increase in persons below poverty (4,700).

Urban counties have larger numbers of persons in poverty but lower poverty rates, relative to rural counties. Many rural counties have relatively small poverty populations but high poverty rates because they have fewer people overall. Obviously, the pattern of the geographic distribution of poverty one sees is dependent on whether absolute numbers or percentages are used.

Another perspective on the geographic distribution of poverty is provided by dividing the number of persons in poverty by the geographic size of the county rather than by its population size. This measures the number of persons in poverty per square mile of the county (i.e., the spatial density of the poverty population). As shown in Figure 3, the urban counties of Kenton, Campbell, Jefferson, Fayette, and Boyd have the highest ratios of persons in poverty per square mile. These are, of course, the counties with higher total population densities. A group of eastern Kentucky counties also has relatively high densities of persons in poverty.

No single measure provides the best estimate of the spatial distribution of poverty but each of the three measures presented provide valuable information. As a percentage of total population in a county, rural counties---particularly in eastern Kentucky---are most affected by poverty. In actual number of persons in poverty and in the spatial density of poverty, urban counties are more affected.

The estimated percentages and numbers of persons below poverty are presented in Tables 1 and 2. Any comments or questions about these estimates should be directed to the authors at the Urban Studies Center.

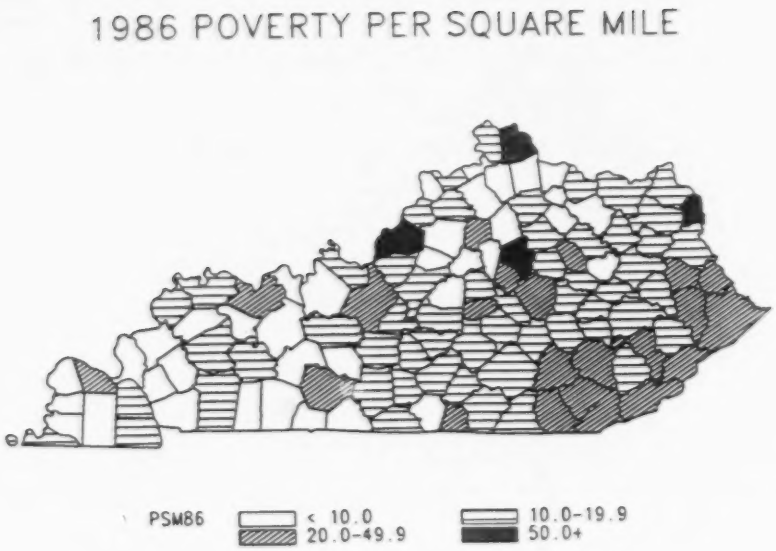

Figure 3: Map of 1986 Kentucky poverty rate per square mile*

*For names of counties, see Appendix for County Reference Map

Table 1

Census Poverty Rates, 1979, and Estimates of Poverty Rates, 1980--1986

Area	Poverty Rates								1979 to 1986 Change
	1979	1980	1981	1982	1983	1984	1985	1986	
United States*	11.7	13.0	14.0	15.0	15.2	14.4	14.0	13.6	1.9
Kentucky	17.6	19.3	19.3	18.8	19.9	19.1	18.7	18.2	0.6
Adair Co.	28.5	30.8	30.5	30.1	31.3	30.2	29.1	29.8	1.3
Allen Co.	20.7	23.2	23.3	23.7	24.8	22.9	22.3	21.9	1.2
Anderson Co.	9.3	10.7	10.8	10.6	10.2	9.3	8.7	8.8	-0.5
Ballard Co.	14.8	18.1	17.1	17.9	18.8	17.5	17.2	16.8	2.0
Barren Co.	17.7	9.3	19.2	19.2	20.0	19.3	19.3	18.7	1.0
Bath Co.	28.3	30.5	30.6	30.5	32.6	31.5	31.2	31.3	3.0
Bell Co.	30.5	32.6	32.8	31.9	34.2	33.6	33.0	33.4	2.9
Boone Co.	6.8	7.8	8.3	8.5	8.4	7.8	7.3	6.7	-0.1
Bourbon Co.	19.6	21.2	20.8	21.9	23.1	20.9	19.8	20.3	0.7
Boyd Co.	13.5	16.4	17.4	17.6	18.9	18.5	18.8	18.6	5.1
Boyle Co.	16.3	17.5	17.3	17.3	18.0	16.8	15.5	15.2	-1.1
Bracken Co.	17.9	19.0	19.0	18.6	20.6	19.6	20.1	19.6	1.7
Breathitt Co.	36.0	36.6	37.9	37.3	40.4	40.7	40.9	40.8	4.8
Breckinridge Co.	22.9	25.1	24.6	23.9	25.7	24.3	23.9	24.1	1.2
Bullitt Co.	9.9	11.3	11.6	11.7	11.8	11.2	10.8	10.5	0.6
Butler Co.	20.8	23.4	23.2	22.0	22.9	21.5	21.1	20.5	-0.3
Caldwell Co.	12.2	13.5	13.2	13.8	14.8	14.4	14.5	13.9	1.7
Calloway Co.	15.3	17.8	18.3	18.0	18.6	17.7	16.9	15.8	0.4
Campbell Co.	9.8	10.5	10.6	10.8	11.1	10.8	10.1	9.3	-0.5
Carlisle Co.	15.7	18.4	17.3	16.8	18.8	15.7	15.8	15.3	-0.4
Carroll Co.	17.8	21.2	21.6	21.5	23.0	22.5	22.3	22.3	4.5
Carter Co.	25.9	28.0	25.1	26.3	27.7	28.3	29.4	30.7	4.8
Casey Co.	35.9	38.5	37.3	36.7	38.3	38.2	38.7	37.9	2.0
Christian Co.	20.2	23.0	22.7	21.5	22.6	21.7	21.0	20.1	-0.1
Clark Co.	16.2	17.8	17.3	16.1	15.7	14.4	14.2	14.1	-2.1
Clay Co.	42.4	44.3	44.2	43.1	46.0	45.0	44.7	45.7	3.3
Clinton Co.	39.4	43.1	41.8	40.1	41.4	41.1	40.7	40.8	1.4
Crittenden Co.	17.3	19.3	19.0	18.7	20.6	19.7	20.2	19.4	2.1
Cumberland Co.	30.6	33.9	33.4	32.1	33.6	33.2	33.1	32.7	2.1
Daviess Co.	12.5	13.2	12.9	12.6	13.3	12.5	12.5	12.5	0.1
Edmonson Co.	22.6	24.7	25.2	25.0	26.0	25.6	25.6	24.8	2.2
Elliott Co.	32.3	34.3	35.7	34.7	38.1	38.3	38.5	38.5	6.2
Estill Co.	28.1	30.1	29.7	29.1	30.0	29.3	28.8	29.0	0.9
Fayette Co.	13.5	14.5	13.7	12.9	12.6	11.3	10.4	9.4	-4.1
Fleming Co.	23.9	26.2	26.1	25.1	26.7	25.8	25.3	25.0	1.1
Floyd Co.	22.3	23.7	25.3	24.0	26.4	27.0	27.3	27.2	4.9
Franklin Co.	10.6	12.6	13.5	12.4	12.0	12.0	11.5	10.7	0.1
Fulton Co.	27.1	30.3	29.4	28.5	30.1	28.0	27.4	27.6	0.5
Gallatin Co.	17.7	18.9	19.0	19.1	20.2	19.7	19.4	18.4	0.7
Garrard Co.	21.7	23.1	22.7	21.3	23.3	21.4	20.9	21.2	-0.5
Grant Co.	13.1	14.3	15.0	15.3	16.2	15.4	14.5	14.1	1.0

Table 1 (Continued)

Census Poverty Rates, 1979, and Estimates of Poverty Rates, 1980--1986

Area	Poverty Rates								1979 to 1986 Change
	1979	1980	1981	1982	1983	1984	1985	1986	
Graves Co.	13.9	16.0	15.9	16.1	17.0	15.2	15.5	14.5	0.7
Grayson Co.	23.1	24.7	23.9	23.7	24.4	23.4	23.3	23.0	-0.1
Green Co.	24.3	25.9	25.4	26.3	28.6	26.5	27.4	27.6	3.3
Greenup Co.	13.1	14.4	14.9	14.5	16.6	15.6	15.2	14.5	1.4
Hancock Co.	14.6	17.0	16.0	17.6	18.8	17.6	17.4	17.2	2.6
Hardin Co.	15.1	16.9	17.0	16.1	16.2	16.1	15.6	15.2	0.2
Harlan Co.	25.8	27.5	27.0	26.0	30.1	30.1	30.1	31.4	5.6
Harrison Co.	19.3	20.8	20.8	20.2	21.6	21.1	20.2	20.6	1.2
Hart Co.	28.2	30.0	30.5	30.6	32.3	31.9	32.2	32.0	3.9
Henderson Co.	11.0	12.4	12.5	12.7	13.4	11.9	11.9	12.0	1.1
Henry Co.	20.0	22.0	22.6	22.8	24.8	23.8	24.0	23.7	3.7
Hickman Co.	18.0	21.6	20.9	21.5	22.3	20.0	20.4	20.0	2.0
Hopkins Co.	14.5	17.4	18.0	17.2	19.4	18.1	17.8	17.6	3.1
Jackson Co.	39.2	42.1	42.1	40.8	42.8	42.5	41.7	42.9	3.7
Jefferson Co.	12.2	13.7	13.5	12.9	13.2	12.6	11.8	11.1	-1.1
Jessamine Co.	14.7	15.5	15.3	14.6	14.5	13.3	12.9	12.9	-1.8
Johnson Co.	22.9	23.8	24.8	23.4	25.2	26.0	26.4	26.0	3.1
Kenton Co.	10.1	11.0	11.4	11.4	11.5	10.8	9.9	9.1	-1.0
Knott Co.	30.9	32.7	32.8	32.2	35.6	35.3	35.4	35.3	4.3
Knox Co.	37.1	39.4	39.9	40.0	42.4	41.3	40.7	40.5	3.4
Larue Co.	22.5	25.2	25.4	26.1	27.3	26.7	26.8	26.9	4.4
Laurel Co.	21.1	23.3	23.5	22.6	23.5	22.4	21.7	21.3	0.1
Lawrence Co.	29.9	32.5	33.7	32.5	34.8	33.9	33.3	32.9	3.0
Lee Co.	33.4	34.7	35.6	34.0	36.2	35.2	34.4	35.1	1.7
Leslie Co.	34.1	35.9	35.0	33.1	36.4	36.1	36.3	36.8	2.7
Letcher Co.	27.4	29.0	29.7	29.6	34.4	33.3	33.3	32.9	5.4
Lewis Co.	31.2	33.6	34.6	33.9	36.3	35.8	35.5	35.2	4.0
Lincoln Co.	27.9	29.9	29.8	28.8	30.0	28.8	27.7	27.4	-0.5
Livingston Co.	14.7	16.5	17.0	17.5	19.6	18.3	18.3	17.0	2.3
Logan Co.	16.2	19.2	18.4	17.0	18.7	16.8	16.9	16.5	0.3
Lyon Co.	13.5	14.6	14.9	14.6	15.7	14.5	14.2	14.3	0.8
McCracken Co.	12.9	14.9	15.1	14.8	15.4	14.9	14.5	14.2	1.3
McCreary Co.	39.5	41.9	42.2	41.7	45.2	44.8	44.6	45.1	5.7
McLean Co.	15.2	18.0	17.2	17.5	19.5	17.2	17.0	16.9	1.7
Madison Co.	21.1	22.7	23.2	22.0	22.3	21.4	21.0	20.8	-0.3
Magoffin Co.	35.0	36.4	36.7	35.3	38.4	38.2	38.4	38.1	3.1
Marion Co.	23.0	25.3	24.9	24.4	25.2	24.1	23.8	23.6	0.5
Marshall Co.	9.8	11.8	12.1	12.5	13.3	12.7	12.3	12.0	2.2
Martin Co.	27.0	29.2	30.0	27.6	32.3	34.2	34.0	35.6	8.6
Mason Co.	19.8	21.1	20.8	21.1	23.2	22.0	21.9	21.5	1.8
Meade Co.	13.6	15.6	15.8	15.0	15.2	14.5	14.0	13.7	0.0
Menifee Co.	28.9	31.5	30.9	31.0	33.0	33.0	32.8	32.8	4.0
Mercer Co.	16.7	17.5	17.2	17.7	17.5	16.2	15.4	15.0	-1.7
Metcalfe Co.	30.8	33.7	34.7	35.5	37.5	36.1	36.4	37.2	6.4

Table 1 (Continued)

Census Poverty Rates, 1979, and Estimates of Poverty Rates, 1980--1986

Area	Poverty Rates								1979 to 1986 Change
	1979	1980	1981	1982	1983	1984	1985	1986	
Monroe Co.	29.1	31.8	31.7	31.8	32.3	30.4	29.6	28.9	-0.2
Montgomery Co.	21.7	24.1	23.8	23.3	24.6	23.4	22.4	22.2	0.5
Morgan Co.	36.7	38.7	39.2	37.4	39.7	40.1	41.7	41.2	4.5
Muhlenberg Co.	15.0	17.1	18.5	17.4	19.6	19.0	19.3	19.2	4.2
Nelson Co.	16.8	18.6	18.9	18.5	19.3	19.0	18.3	17.9	1.1
Nicholas Co.	21.0	22.0	22.4	22.0	23.1	21.8	21.2	21.3	0.3
Ohio Co.	17.1	20.4	21.7	20.8	22.6	21.8	22.5	22.6	5.6
Oldham Co.	6.5	8.0	8.4	8.3	7.9	7.2	6.9	6.7	0.3
Owen Co.	23.2	24.8	25.1	24.1	26.4	24.5	24.2	23.8	0.6
Owsley Co.	48.3	50.5	49.8	49.7	51.7	51.5	51.8	52.9	4.6
Pendleton Co.	17.3	18.7	19.7	19.5	21.8	21.6	20.6	20.1	2.9
Perry Co.	24.3	27.2	26.6	26.8	29.7	29.7	29.9	29.4	5.1
Pike Co.	19.4	20.2	22.5	20.7	25.1	25.1	26.0	24.9	5.5
Powell Co.	25.6	27.0	27.5	26.7	27.4	26.0	24.8	24.7	-0.9
Pulaski Co.	22.3	24.4	24.0	23.7	24.7	23.9	23.5	24.0	1.6
Robertson Co.	24.5	25.8	25.4	23.7	25.5	25.2	26.0	26.6	2.1
Rockcastle Co.	33.1	35.7	36.0	36.0	37.6	36.8	35.7	35.1	2.0
Rowan Co.	21.8	23.1	23.3	23.2	24.1	23.8	23.2	22.7	0.9
Russell Co.	32.4	35.1	34.3	32.7	33.1	32.6	31.9	31.4	-1.0
Scott Co.	14.1	14.8	14.5	13.8	14.2	12.1	11.6	12.1	-2.0
Shelby Co.	14.8	16.3	16.8	17.1	18.0	16.4	15.5	15.2	0.4
Simpson Co.	16.5	19.1	18.1	18.4	18.6	16.2	15.9	14.9	-1.7
Spencer Co.	18.2	20.0	19.0	19.4	21.7	20.7	20.8	20.6	2.3
Taylor Co.	18.8	20.2	20.4	20.2	21.2	20.7	20.6	20.1	1.3
Todd Co.	19.8	23.7	22.9	22.6	24.7	22.2	22.2	22.1	2.3
Trigg Co.	17.3	20.5	20.1	20.4	21.9	20.0	19.7	19.0	1.6
Trimble Co.	13.2	14.4	14.5	14.7	16.4	15.7	15.6	14.8	1.6
Union Co.	22.2	26.2	28.1	25.9	32.8	29.2	27.9	26.6	4.4
Warren Co.	15.3	17.1	16.7	17.3	18.1	17.3	16.5	16.7	1.4
Washington Co.	23.2	25.4	24.5	24.4	25.7	24.0	23.8	23.0	-0.1
Wayne Co.	35.1	37.7	37.3	37.3	38.7	38.0	37.7	37.3	2.3
Webster Co.	17.9	20.5	21.0	20.6	24.1	21.2	21.4	20.6	2.8
Whitley Co.	26.6	28.7	29.2	28.1	29.9	28.7	28.1	28.4	1.8
Wolfe Co.	34.9	36.6	36.3	36.2	38.5	37.8	39.6	41.1	6.3
Woodford Co.	11.6	11.8	10.0	5.9	3.5	1.9	2.5	3.4	-8.2

Source: Urban Studies Center, University of Louisville

*The national poverty rate is estimated from the Current Population Survey.

Table 2

Estimates of Number of Persons in Poverty, 1979--1986

County	1979	1980	1981	1982	1983	1984	1985	1986	1979 to 1986 Change	1979 to 1986 %
Kentucky	641300	706500	709300	694600	739300	711200	697200	678000	36700	5.7
Adair	4300	4700	4700	4700	4800	4800	4600	4700	400	9.3
Allen	2900	3300	3300	3300	3500	3300	3200	3200	300	10.3
Anderson	1100	1300	1400	1400	1300	1200	1200	1200	100	9.1
Ballard	1300	1600	1500	1500	1600	1500	1400	1400	100	7.7
Barren	6000	6600	6600	6700	7000	6700	6700	6500	500	8.3
Bath	2800	3100	3100	3100	3400	3200	3100	3200	400	14.3
Bell	10400	11200	11300	11000	11900	11700	11400	11400	1000	9.6
Boone	3000	3600	3900	4100	4200	3900	3700	3500	500	16.7
Bourbon	3700	4100	4000	4200	4500	4100	3800	4000	300	8.1
Boyd	7500	9100	9600	9700	10400	10000	10100	9900	2400	32.0
Boyle	4000	4400	4300	4300	4500	4200	3900	3900	-100	-2.5
Bracken	1400	1500	1400	1400	1600	1500	1500	1500	100	7.1
Breathitt	6200	6200	6500	6300	6800	6700	6700	6700	500	8.1
Breckinridge	3800	4200	4100	4000	4300	4100	4100	4100	300	7.9
Bullitt	4200	4900	5100	5200	5200	5000	5000	4900	700	16.7
Butler	2300	2600	2500	2400	2600	2500	2400	2200	-100	-4.3
Caldwell	1600	1800	1800	1900	2000	1900	1900	1900	300	18.8
Calloway	4500	5300	5500	5400	5500	5400	5100	4800	300	6.7
Campbell	8200	8700	8700	9000	9100	8800	8200	7600	-600	-7.3
Carlisle	900	1000	900	900	1000	800	800	800	-100	-11.1
Carroll	1700	2000	2000	2100	2200	2200	2200	2100	400	23.5
Carter	6400	7000	6300	6700	7100	7200	7500	7700	1300	20.3
Casey	5300	5700	5600	5600	5800	5800	5800	5600	300	5.7
Christian	13600	15400	15000	14200	14900	14000	13600	12800	-800	-5.9
Clark	4600	5000	5000	4600	4500	4200	4100	4100	-500	-10.9
Clay	9600	10100	10100	10000	10800	10600	10600	10800	1200	12.5
Clinton	3700	4000	4000	3900	4000	4100	4000	4000	300	8.1
Crittenden	1600	1800	1700	1700	1900	1800	1800	1700	100	6.3
Cumberland	2300	2500	2500	2400	2500	2500	2400	2400	100	4.3
Daviess	10700	11300	11200	11000	11700	11100	11100	11000	300	2.8
Edmonson	2200	2500	2500	2600	2700	2700	2700	2600	400	18.2
Elliott	2200	2400	2500	2400	2700	2600	2600	2600	400	18.2
Estill	4100	4400	4300	4200	4500	4400	4300	4300	200	4.9
Fayette	27400	29600	28200	26900	26500	23800	22500	20700	-6700	-24.5
Fleming	2900	3200	3200	3100	3300	3200	3100	3100	200	6.9
Floyd	10800	11600	12400	11900	13400	13500	13600	13400	2600	24.1
Franklin	4400	5300	5800	5300	5200	5300	5000	4700	300	6.8
Fulton	2400	2700	2600	2500	2500	2300	2200	2200	-200	-8.3
Gallatin	800	900	900	900	1000	1000	900	900	100	12.5
Garrard	2400	2500	2600	2400	2700	2500	2400	2400	0	0.0
Grant	1600	1900	2000	2100	2300	2200	2000	2000	400	25.0
Graves	4700	5400	5400	5400	5600	5000	5100	4900	200	4.3

Table 2 (Continued)

Estimates of Number of Persons in Poverty, 1979--1986

County	1979	1980	1981	1982	1983	1984	1985	1986	1979 to 1986 Change	1979 to 1986 %
Grayson	4700	5200	5000	5100	5300	5100	5100	5000	300	6.4
Green	2700	2900	2800	2900	3100	2900	3000	3000	300	11.1
Greenup	5100	5600	5800	5600	6400	6000	5800	5400	300	5.9
Hancock	1100	1300	1200	1400	1500	1400	1400	1400	300	27.3
Hardin	12900	15000	14600	14300	14700	15000	14900	14100	1200	9.3
Harlan	10900	11500	11500	11100	12800	12600	12500	12900	2000	18.3
Harrison	2900	3200	3200	3100	3300	3300	3200	3300	400	13.8
Hart	4200	4600	4600	4700	4900	4900	4900	4800	600	14.3
Henderson	4400	5100	5200	5300	5600	5000	5000	5100	700	15.9
Henry	2500	2800	2900	3000	3300	3200	3200	3200	700	28.0
Hickman	1100	1300	1300	1300	1300	1200	1200	1100	0	0.0
Hopkins	6700	8000	8400	8000	9100	8400	8300	8200	1500	22.4
Jackson	4600	5100	5200	5000	5300	5300	5200	5300	700	15.2
Jefferson	84400	93800	92100	88400	90400	86200	80400	75500	-8900	-10.5
Jessamine	3900	4100	4100	4000	4000	3800	3700	3800	-100	-2.6
Johnson	5500	5800	6100	5800	6400	6700	6800	6600	1100	20.0
Kenton	13600	15100	15600	15600	15700	14800	13600	12600	-1000	-7.4
Knott	5500	5900	6000	5900	6500	6500	6400	6400	900	16.4
Knox	11200	11900	12200	12100	12800	12300	12200	12100	900	8.0
Larue	2600	3000	3000	3100	3300	3300	3200	3200	600	23.1
Laurel	8000	9100	9400	9100	9600	9200	9100	9100	1100	13.7
Lawrence	4200	4600	4800	4700	5100	5000	4900	4800	600	14.3
Lee	2600	2700	2700	2600	2800	2800	2700	2700	100	3.8
Leslie	5100	5300	5200	5000	5600	5600	5600	5500	400	7.8
Letcher	8400	8900	9200	9100	10700	10100	10100	9800	1400	16.7
Lewis	4500	4900	5100	5000	5300	5200	5100	4900	400	8.9
Lincoln	5400	5700	5700	5500	5800	5500	5300	5300	-100	-1.9
Livingston	1400	1500	1600	1600	1800	1700	1700	1500	100	7.1
Logan	3900	4600	4500	4200	4700	4300	4300	4200	300	7.7
Lyon	900	900	1000	900	1000	900	900	900	0	0.0
McCracken	7900	9100	9300	9100	9500	9100	8800	8500	600	7.6
McCreary	6100	6600	6700	6700	7200	7300	7300	7400	1300	21.3
McLean	1600	1800	1700	1700	1900	1700	1700	1700	100	6.3
Madison	11000	12100	12500	11800	12100	11600	11600	11600	600	5.5
Magoffin	4700	4900	5100	4900	5400	5400	5400	5400	700	14.9
Marion	4200	4500	4500	4300	4500	4300	4200	4100	-100	-2.4
Marshall	2500	3000	3100	3200	3500	3300	3200	3200	700	28.0
Martin	3700	4100	4300	4000	4700	4900	4800	5000	1300	35.1
Mason	3600	3700	3700	3700	4000	3800	3800	3800	200	5.6
Meade	3000	3600	3600	3400	3500	3400	3300	3300	300	10.0
Menifee	1400	1600	1600	1700	1800	1700	1700	1700	300	21.4
Mercer	3100	3300	3300	3400	3300	3200	3100	3000	-100	-3.2
Metcalfe	2800	3200	3300	3500	3700	3600	3600	3700	900	32.1
Monroe	3700	3900	3900	3900	4000	3800	3700	3500	-200	-5.4

Table 2 (Continued)

Estimates of Number of Persons in Poverty, 1979--1986

County	1979	1980	1981	1982	1983	1984	1985	1986	1979 to 1986 Change	1979 to 1986 %
Montgomery	4200	4800	4800	4700	5000	4800	4600	4500	300	7.1
Morgan	4400	4700	4800	4500	4900	4900	4900	4800	400	9.1
Muhlenberg	4800	5500	6000	5600	6200	6100	6100	6000	1200	25.0
Nelson	4500	5100	5300	5200	5500	5500	5300	5200	700	15.6
Nicholas	1500	1600	1600	1600	1700	1600	1500	1600	100	6.7
Ohio	3800	4400	4700	4400	4800	4800	4800	4800	1000	26.3
Oldham	1700	2200	2400	2500	2400	2300	2200	2200	500	29.4
Owen	2100	2200	2200	2200	2400	2300	2200	2200	100	4.8
Owsley	2800	2900	2900	2800	2900	2900	2900	3000	200	7.1
Pendleton	1900	2100	2100	2100	2400	2300	2300	2200	300	15.8
Perry	8200	9200	9000	9200	10400	10300	10400	10200	2000	24.4
Pike	15600	16400	18400	17000	20900	20700	21400	20300	4700	30.1
Powell	2800	3000	3100	3100	3200	3100	2900	2900	100	3.6
Pulaski	10300	11200	11000	11300	11800	11600	11500	11300	1000	9.7
Robertson	600	600	600	500	600	600	600	600	0	0.0
Rockcastle	4600	5000	5000	5000	5300	5300	5200	5100	500	10.9
Rowan	4300	4400	4700	4400	4600	4600	4500	4300	0	0.0
Russell	4400	4800	4900	4800	4900	4900	4700	4600	200	4.5
Scott	3000	3200	3200	3000	3100	2600	2500	2700	-300	-10.0
Shelby	3400	3800	4000	4100	4300	3900	3700	3600	200	5.9
Simpson	2500	2800	2600	2700	2800	2400	2400	2200	-300	-12.0
Spencer	1100	1200	1100	1100	1300	1300	1300	1300	200	18.2
Taylor	3900	4300	4300	4300	4600	4500	4500	4400	500	12.8
Todd	2400	2800	2700	2600	2700	2500	2400	2400	0	0.0
Trigg	1600	1900	1900	1900	2000	1900	1900	1800	200	12.5
Trimble	800	900	900	900	1000	1000	1000	900	100	12.5
Union	4000	4700	5000	4600	5900	5200	4900	4600	600	15.0
Warren	10800	12300	12500	13600	14500	13700	13100	13500	2700	25.0
Washington	2500	2700	2600	2600	2700	2500	2400	2400	-100	-4.0
Wayne	5900	6400	6400	6500	6800	6700	6600	6600	700	11.9
Webster	2600	3000	3100	3100	3600	3100	3100	2900	300	11.5
Whitley	8800	9600	9800	9600	10400	10200	9900	10000	1200	13.6
Wolfe	2300	2500	2400	2500	2700	2700	2700	2800	500	21.7
Woodford	2100	2100	1800	1100	600	400	500	600	-1500	-71.4

THE APPROACH TO ESTIMATING POVERTY RATES

There are four approaches to estimating a measure such as a poverty rate. The preferred approach is to conduct a survey using scientific data collection techniques that enable the preparation of an estimate with a known probability of error of a specified margin based on sampling theory. This is also the most expensive approach, and the costs for local estimates, outside of the massive data collection of the decennial census, are usually prohibitive.

The second approach is to estimate the rate from an "accounting" or administrative records model that derives the estimate from individual components that are directly measured. An example of this approach is the well-known components of change population equation, which is based on births, deaths, and migration. The first two components are measured directly from administrative records and the third is estimated from other administrative records (such as social security records). An accounting model has not been created for poverty, although it is potentially possible if income tax records and income maintenance program records were used. There are thorny problems with this approach concerning program coverage and access to records. To date, no state is allowing access to its administrative records at a sufficient level of detail to make such estimates. And no one has developed an accounting model for estimating poverty from aggregated administrative data.

The third approach is a causal model, which estimates the incidence of poverty as a function of individual household characteristics such as age, household type, and employment. Causal models of income have been developed, but these are most useful in understanding the dynamics of income change rather than in estimating poverty.

The fourth approach is a social indicators model. The poverty rate is estimated from surrogate measures of poverty, or social indicators, which are expected to systematically vary with poverty. Some of these indicators might be causally related to poverty (e.g., unemployment), but the model does not imply or test a causal relationship. A simple social indicators model would estimate the poverty rate as a constant ratio to one other indicator such as the percentage of households receiving public assistance. A more complex model would use statistical techniques, such as linear regression, to estimate an equation that relates the poverty rate to one or more social indicators. This is the approach followed here.

The selected model was first calibrated on 1969 data for all 120 counties of the state. The model was then used to estimate the 1979 poverty rate for the 120 counties based on the 1969 model coefficients. Results were compared with the poverty rates estimated from the 1980 census. The model was then recalibrated using the 1979 data, and the 1979 coefficients were used to estimate the poverty rate for subsequent years.

DESCRIPTION OF SOCIAL INDICATORS USED

A comprehensive data set of social indicators that could potentially co-vary with the poverty rate was assembled and cross-sectional models (stepwise linear regression) were estimated for 1969 and 1979 using the decennial census estimate of the percentage of persons below poverty as the dependent variable and the social indicators as the independent variables. The independent variables can be divided into four groups: demographic, income, employment, and public assistance.

Demographic variables included the age of the population, the age of the householder, and the type of household. These measures are annual estimates prepared by the Urban Studies Center.

The income measures were prepared by the Bureau of Economic Analysis (BEA) and by the Urban Studies Center (USC). The BEA measures included per capita income, income maintenance payments, social security payments, unemployment insurance payments, transfer payments, and related program payments included in BEA's estimates of transfer payments. These were expressed in per capita amounts or as percentages of totals. The USC measures were median family income and gross income per taxpayer (based on state tax returns).

Employment measures included the unemployment rate (estimated by the Kentucky Cabinet for Human Resources) and the percentage distribution of employment by industry (based on BEA estimates). The public assistance measures used (in addition to the BEA transfer payments data) were the average monthly recipients by assistance program and the total payments by type of assistance (from the Kentucky Cabinet for Human Resources).

All independent variables were expressed as per capita amounts or percentages.

CALIBRATING AND TESTING THE 1969 MODEL

Six variables entered the stepwise regression model for the 1969 poverty rate. The overall 6-variable model had an R^2 of .93, indicating a good overall fit of the model to the cross-sectional data. The variables in the model were: income maintenance payments per capita, per capita income, the ratio of money and vendor payment cases to AFDC total cases, per capita unemployment insurance payments, gross income per taxpayer, and per capita assistance payments. However, the 6-variable model adds little to the goodness of fit of a 2-variable model using income maintenance payments per capita and per capita income, which has an R^2 of .91. There are serious multicollinearity problems with the 6-variable model, and the additional four variables are apparently adjusting the estimates for only a few cases. Some problems were also encountered regarding the logical interpretation of the coefficients of unemployment insurance and per capita assistance payments, both of which had negative coefficients. Per capita unemployment insurance payments were unrelated to the poverty rate by itself and per capita assistance payments were positively associated with the poverty rate. These anomalous results suggest that the coefficients for these variables

would be highly unstable. (None of the same variables after income maintenance payments and per capita income entered into the 1979 equation.)

A 2-variable model (see Table 3) calibrated on the 1969 poverty rate using income maintenance payments and per capita income was selected for testing against the 1979 poverty rate. All values were expressed in constant 1979 dollars to eliminate a scaler effect due to inflation.

Table 3

1969 Model for Estimating County Poverty Rates

Independent Variable	Coefficient	R^2
Per capita income* maintenance payments	134.1093	.829
Per capital income*	-.0042	.907
Constant	39.486	

*1969 values converted to 1980 dollars

The initial estimates systematically overestimated the poverty rate for 1979. Given the decline in poverty during the decade, this was an expected result of a cross-sectional model. The average absolute error was 11 percentage points and 57 counties had errors over 10 points. This could potentially be corrected if a state control reflecting the overall trend in poverty was available. By multiplying the county-level estimates by the county's population, the number of persons in poverty can be summed for the state and a state poverty rate calculated. Controlling this state rate to an exogenously determined state-level estimate would allow the county estimates to be adjusted so that their population products would sum to the state control for persons in poverty. This can be done by simply calculating the ratio of the exogenously determined state poverty rate to the uncorrected endogenous rate and multiplying this ratio across the uncorrected county-level poverty rate estimates.

Controlling to a state estimate (rather than treating the state as the one hundred twenty-first case of independent rates) also places higher weights on the counties with the largest poverty populations, such as Jefferson County. Because these counties have higher numbers of persons below poverty, even if their poverty rates might be lower than many other counties, more importance should be attached to accurately estimating their poverty rates.

A perfect state control would be within the sampling error of the state-level poverty rate from the decennial census. There are two potential sources for a state control: the Current Population Survey and the Survey of Income and Program Participation. These will be discussed in a

subsequent section. For testing purposes, we will assume that the state poverty rate can be accurately determined by an exogenous estimate and by the use of the 1980 census rate for our exogenous control. It is stressed that this is an ideal situation. No other exogenous control is likely to exactly match the census poverty estimate, which by definition is consistent with the county-level rates that are being interpreted as the "true" poverty rates for each county.

Using the 1980 census as a state control dramatically improves the model. The average absolute difference (error) between the county estimates corrected by the state control and the 1979 poverty rates reported by the census was 2.4 percentage points. The maximum absolute error was 12.5 points and the minimum was .02 points. The cumulative distribution of the counties by the margin of error in their poverty estimates is presented in Table 4. Fifty-five percent were within 2 percentage points and almost 90 percent were within 5 points. Extreme errors were rare, with the maximum being 12.5 points. The thirteen counties with the largest errors (Hopkins, Butler, Owsley, Leslie, Powell, Menifee, Webster, Breathitt, Lee, Magoffin, Bourbon, Wolfe, and Union) were mostly in eastern Kentucky where poverty rates are high and where the change in rates between 1969 and 1979 was most dramatic.

Table 4

Test of 1969 Coefficients to Estimate 1979 Poverty Rates
Estimates (Controlled to State Poverty Rates)

Percentage Point Difference Between 1979 Estimate and Census	Cumulative Percent of Cases
±1.0	30.0
±2.0	55.0
±3.0	72.5
±4.0	83.3
±5.0	89.2
±6.0	92.5
±7.0	95.0
±8.0	95.8
±12.5	100.0

The average of the 120 county poverty rates from the 1980 census was 20.7 percent. As just noted, the average error was 2.4 points and most counties were within 5 points. While the utility of estimates with this magnitude of error depends on the user, the error can be compared to that recorded for county-level unemployment rates, which are widely used. The average absolute difference across 120 counties between the unemployment rate reported by the 1980 census and the

unemployment rate estimated by the Cabinet of Human Resources using standard Department of Labor methods was 2.1 percentage points. Given that unemployment rates have a much narrower range than poverty rates, it would appear that the poverty rates estimated herein should be acceptable to most public data users.

CALIBRATING THE 1979 MODEL AND ESTIMATING 1980--1986 POVERTY RATES

The stepwise cross-sectional model for 1979 also included per capita income maintenance payments and per capita income, followed by the unemployment rate and money payments per capita. Again, a 2-variable model with an R^2 of .91 was nearly equal in fit to a 4-variable model with an R^2 of .92. The coefficients for the 1979 2-variable model are given in Table 5 and have been used in estimating poverty rates for 1980--1986. Subsequent years will be estimated as data become available for the two independent variables.

Table 5

1979 Model for Estimating County Poverty Rates

Independent Variable	Coefficient	R^2
Per capita income maintenance payments	79.71	.860
Per capita income	-.0019	.907
Constant	21.432	

Two issues needed to be addressed in applying the model to post census estimates. The first is the notch effect created if the estimation series is not controlled to the census-reported 1979 poverty rate for each county, and the second is the use of a state control.

The notch effect can be handled in one of two ways. Either the series can start with a 1979 poverty rate estimated by the model that differs from the 1980 census rate or the series can be adjusted so that it agrees with the 1980 census. Rather than create confusion over the 1979 rates, the latter choice was selected. The series has been adjusted to the 1979 poverty rate for each county, and subsequent years are estimated as the product of that rate and the ratio of the model estimates for the year given and 1979.

The Current Population Survey was examined as a state control. In 1982, the sampling frame for the CPS was changed to enable state-level estimates. The poverty rates for Kentucky derived from the CPS for the 1980s are given in Table 6. The CPS estimate for 1979 was 5.6 points lower

than the rate reported in the 1980 census (12.0% versus 17.6%). There was also an unexpected drop in 1982 of 3 points to 16.2 percent. Because this was a recession year with high unemployment, the drop is possibly a result of changes in the sampling and weighting procedures used in the CPS. The estimates for the subsequent year increased to 18.0. (The CPS estimate for 1984 was 19.4 percent.) Unfortunately, the CPS estimates for Kentucky appear to be too erratic for this period to be of much value as state controls. The sampling error for the CPS estimates is approximately 1.8, so the 95 percent confidence interval would be $\pm$3.5. Given the size of the sampling error for the CPS estimates, state level controls would be better estimated by pooling two or three years of CPS data and estimating a two- or three-year moving average. Sample sizes in the Survey of Income and Program Participation (SIPP) are similar to those in the CPS. However, the SIPP sample is stratified to include a larger proportion of the low-income population. As yet, state estimates of poverty have not been derived from the SIPP data.

Table 6

1979--86 Poverty Rates for Kentucky
Current Population Survey (CPS) and Urban Studies Center Estimates (USC)

Year	CPS[a]	USC
1979	12.0	17.6
1980	19.3	19.3
1981	19.3	19.3
1982	16.2	18.8
1983	18.0	19.9
1984	NA	19.1
1985	19.4	18.7
1986	NA	18.2

[a]From Christine Ross and Sheldon Danziger, "Poverty Rates by States, 1978--1985: Estimates from the Annual Current Population Surveys." Madison, WS: Institute for Research on Poverty.

The state poverty rates calculated from the model for 1980 through 1986 without an exogenous control (also shown in Table 6) are very stable and appear to be reasonable, based on national trends and the CPS estimates (except for the CPS estimate for 1982, which is problematic). Until the unconstrained estimates from the model diverge from the CPS estimates, the county estimates will be derived from the unconstrained model.

APPENDIX

KENTUCKY COUNTY REFERENCE MAP

Kentucky County Reference Map